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ABSTRACT

To determine which elements of courseware are and are not effective in computer-based education, 59 learning disabled students were observed during a 5 1/2-month period using over 20 commercial courseware packages. Additional elements of the naturalistic study included interviews with teachers, students, and administrators; and analysis of the courseware, its documentation, and participating students' records. Preliminary findings have suggested that students already possess a high level of computer sophistication, and that competition with one's self and among other students is a highly motivating factor in courseware use. Implications for courseware design are noted. (CL)

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LEARNING DISABILITIES AND MICROCOMPUTER COURSEWARE: A QUALITATIVE STUDY OF STUDENTS' AND TEACHERS' INTERACTIONS WITH INSTRUCTIONAL DIMENSIONS

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Introduction

Special education, like all areas of education, has been inundated with microcomputers over the past several years. The technological advances and associated hype that have pushed the micro into the consciousnesses of regular educators have marched it into the forefront of special educators' minds as well. Research publications, "tips-for-practitioners" articles, state and national conferences, local and regional workshops, professional organizations, even the popular press—all have focused attention on the promise that microelectronics holds for the student with special learning needs. Touted as the supreme motivator, the infinitely patient tutor, and the ultimate provider of individualization, the microcomputer has fired the imaginations of many concerned with uncovering ways to tap and maximize the potentials of the over 15 million school-age Americans identified as handicapped.

There is surprisingly little empirical evidence, however, to support the claims of the enthusiasts. In the field of mild learning handicaps, for example, only a few sound studies that address the instructional effectiveness of computer courseware for this population can be found among the plethora of publications that survey the current number and uses of computers in special education; decry the lack of courseware developed specifically for learners with special needs; offer suggestions for evaluating, selecting, and implementing what is available; and provide radically differing predictions of the future of the computer in special education. Moreover, the studies that are available (e.g., Chiang et al., 1978; Lally, 1981; McDermott & Watkins, 1983) primarily compare computer-based education (CBE) with instruction by conventional means and suggest only moderate gains or simple equivalence for target groups that use the computer. None of the published studies examines in a systematic

and rigorous way the actual use of courseware in an ongoing instructional context with students with mild learning handicaps.

Thus, existing studies neither justify widespread enthusiasm for CBE for special-needs students nor provide many insights into the reasons this mode of instruction might be effective with them. In particular, the studies do not consider which specific characteristics of courseware--the sine qua non of CBE--are more and less successful in enhancing such students' learning. Until special educators have a great deal more empirically based knowledge about this fundamental area, we will not be able to use CBE to fulfill its promise for our constituency. The ultimate purpose of the study reported here is to determine which elements of courseware are and are not effective in an actual instructional setting as a first step in creating guidelines for developing courseware that truly meets the needs of mildly handicapped students and their teachers.

Research Questions

In order to move beyond cross-method comparisons and to begin to explore instructional dimensions of courseware potentially significant to learning-disabled students, this study is investigating two major research questions:

I. How do students with learning disabilities perceive, react to, and interact with various instructional dimensions of the CBE courseware to which they are exposed?

II. How do teachers of these students perceive various instructional aspects of CBE courseware and use these to enhance their students' learning?

Subsumed under these general questions are a number of specific foci gleaned from literature related to three fields: instructional systems design (ISD); CBE; and mild learning handicaps, particularly the emerging

area of courseware design for this population. Synthesizing findings from a diversity of sources from all these fields (see Appendix A) led to the identification of a wide range of instructional characteristics that might be especially important for CBE for mildly handicapped students. In an effort to determine which of these dimensions emerge as truly significant for these students and their teachers, this range is under scrutiny during this study:

IA. The particular ways in which the students in the study perceive, react to, and interact with critical components of courseware:

1. The presentation of the stimulus, for example,
   a) elements of concept development, such as the logic and completeness of the presentation and the provision of examples and nonexamples;
   b) features of display design, such as techniques for focusing students' attention by highlighting relevant stimulus characteristics;
   c) motivational features, such as instances of fantasy, curiosity, and challenge incorporated into the courseware "scenario."
2. The elicitation of the response, for example,
   a) pacing,
   b) various levels of questioning,
   c) opportunities for practice,
   d) kinds of hints,
   e) amount of interactivity,
   f) consistency/inconsistency of response options.

3. The provision of reinforcement, for example,

a) kinds and levels of feedback and branching,

b) overt and covert attempts to enhance students' self-esteem.

B. The strategies that students develop to deal with various kinds of courseware and various levels of difficulty within those kinds:

1. Academic strategies,

2. Coping strategies.

C. The effectiveness of courseware with the target students in developing academic skills:

1. Basic skills, for example,

a) language-arts skills,

b) computation skills.

2. Higher-level skills, for example,

a) improved memory,

b) problem solving,

c) divergent thinking,

d) error handling.

D. The effectiveness of courseware with the target students in enhancing personal development:

1. Independence,

2. Self-confidence,

3. Positive self-concepts,

4. Feelings of active agency.

IIA. The classification(s) of courseware and particular examples of each perceived by the teachers to be most and least effective for their students and the reasons for these perceptions:

1. Drill and practice,

2. Tutorial,

3. Simulation.

B. The strategies teachers develop to capitalize on perceived strengths and/or to compensate for perceived weaknesses in courseware in order to enhance the value of CBE for their students.

C. The ways in which students' CBE experiences are/are not integrated into ongoing classroom instruction and the reasons and procedures related to this factor.

D. Teachers' perceptions of their students' development of personal and social competencies and basic and higher-level academic skills through CBE.

Methodology

The study is being conducted and reported according to established tenets and procedures of naturalistic inquiry that have been identified as pertinent to educational research by Guba (1981), Bogdan and Biklen (1982), and Miles and Huberman (1984). The rationale for approaching the study through this paradigm is suggested by many authors who cite the need to acquire detailed, in-depth information about the effectiveness of various instructional dimensions of courseware as these are actually encountered during normal instruction. (See, for example, Cohen, 1983b; Della-Piana & Della-Piana, 1982; Hall, 1978; Kearsley, Hunter, & Seidel, 1983; and Stainback & Stainback, 1984).

The setting for the study is the Marburn Academy, a private school for learning-disabled (LD) students located in Columbus, Ohio. Founded in 1981 with 16 students, Marburn currently enrolls 76 students in three divisions (lower, middle, and upper). The school has four Apple II computers with single disk drives in instructional use, and many of the students have access to family computers at home. Fifty-nine students

from the middle and upper divisions and seven teachers from four subject-matter areas (language arts, math, social studies, and careers) are participating in the study.

Marburn has been extremely supportive of the study--for example, sending to parents/guardians under the school's own cover letter the researcher's letter explaining the study and the consent forms required by The Ohio State University for students to participate. Marburn also allowed the researcher to speak to faculty at several times to explain the nature, purpose, and procedures of the study; to gain faculty consent to participate; and to answer any questions that arose throughout the data collection effort.

This effort involved several techniques common to naturalistic inquiry. Primary among these was prolonged observation (5 1/2 months during the spring and fall of 1984 and the winter of 1985) of the participants' use of over 20 commercial courseware packages. Initially, these observation sessions were informal and unstructured in order to permit the gathering of preliminary data on which of the instructional dimensions outlined in the research questions seemed the most promising to investigate. As the fieldwork progressed, the observations remained informal but were focused increasingly on the dimensions that seemed most salient in the research setting. Questions to students about their interactions with the courseware were incorporated into the observation sessions as a means of confirming or denying the accuracy of the researcher's observations. After each observation session, raw notes taken at the setting were expanded into extensive interpretive fieldnotes that served both to refine and direct the focus of the continuing fieldwork and to provide the basis for the final data analysis.

Another data-gathering technique involved interviewing participants

toward the middle and end of the data collection period. A total of 19 audiotaped interviews was conducted: teachers, a teacher/administrator, and the headmaster were interviewed individually, while students were interviewed in small groups. The interviews were guided by informal interview schedules (i.e., lists of questions and probes for use in following up those questions) developed as the observations progressed. The schedules were designed to expand upon or clarify issues and questions raised during the observations and to confirm or deny tentative conclusions reached by the researcher. The same interview schedule was used for each group of students, while a core of questions asked of each teacher was expanded to cover points that seemed particularly significant about each individual. The schedule for the headmaster was designed to elicit information about the administrative context of the research setting. Transcripts of the interviews have joined the fieldnotes to serve as the basis for the final data analysis.

A third method of data collection involved the examination of a variety of materials related to the study: the courseware itself, its documentation, a number of materials (such as schedules) produced by Marburn, and participating students' records. Secondary in focus and significance, this document analysis is intended to corroborate and enrich the information gleaned through the observations and interviews.

Ongoing data analysis has continued throughout the study as fieldnotes were compiled and reviewed, interview tapes and transcripts were examined, and notes on documents were incorporated into the growing body of material upon which the final analysis will be based. This final phase is currently underway as the researcher develops and assigns to the material coding categories that reflect not only the general questions and specific foci delineated in the research questions but also a number of

other dimensions that emerged during the data collection phase as particularly significant. When all the material has been coded, it will be transferred to the University's mainframe computer for an initial sorting into the categories. The next step will involve the analysis of material within and across categories in an attempt to discover themes and patterns related to the sound design and effective use of CBE courseware with students like those involved in the study. These themes and patterns will provide the conceptual structure according to which the findings and implications of the study will be presented.

Findings and Implications

Because the data analysis is not yet complete, it would be premature to report definitive findings in this paper. Nevertheless, it is possible at present to note several general trends appearing in the data that seem to be of some importance.

First, although some of the instructional dimensions identified through the literature and specified prior to the fieldwork have not emerged as significant, most others have. For example, while the preponderance of drill-and-practice programs in use at the site makes it unreasonable to draw conclusions about such dimensions as the effects of different levels of questioning and the development of divergent-thinking skills, information about such dimensions as display design, response requirements, the efficacy of various types of reinforcement, and the students' uses of academic and coping strategies is plentiful and is sure to lead to well-grounded findings.

Second, while the observations and interviews have confirmed many of the suggestions offered by authors in the field without benefit of such grounded inquiry, the data collection has also uncovered dimensions not discussed in much of this work. For example, while the study reinforces

opinions about such dimensions as students' need for simple response options and teachers' need for flexible courseware that allows them to specify content, the research also reveals a high level of computer sophistication among the students--a dimension that has serious implications for courseware design but that is barely touched upon in the research literature.

Indeed, it is the examination of one of these unanticipated dimensions--competition--that is likely to yield the most significant findings of the study. Observation after observation revealed the extraordinary power of competition as a motivating factor. Not only do students respond with enthusiasm to courseware that is designed to be competitive, they also make CBE activities competitive even when there is no evidence of a competitive thrust in their design. Competition against the self (e.g., beating one's own best score) and against others (e.g., beating the score of another student named within a package as "champion") consistently motivated students to attend and perform. One reading game, for example, kept five middle-division students reading for almost an hour--including, at the students' request, through recess.

A thoughtful consideration of the many instances of competition observed in the classrooms and explored in the interviews, of the reasons for the students' competitive approach to courseware (one of which might be their familiarity with computer games), and of the nature of that competition within the classroom environment (generally affirming and supportive rather than cutthroat) should yield important insights that can then be translated into principles for courseware design. Obviously, for students who use the words "disk" and "game" interchangeably and who often speak of "playing disks" at school as well as at home, the implications of competition for courseware design are likely to be profound.

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Appendix A

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